

Studies on Physico-chemical Characteristics of Pomegranate Cultivars Grown Under Arid Conditions

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Abstract: Different pomegranate cultivars, grown successfully under arid conditions, were evaluated with respect to their physico-chemical characteristics. It revealed that inter-varietal differences were highly significant for most of the physical parameters such as weight of fruits (g) and contents (%) of juice, aril, rind, and seed. The fruit cracking was quite high in cv. Jodhpur Red, whereas it was least in cv. Jalore seedless. A high juice content (fruit weight basis), ranging from 40.8 to 52.7%, was recorded in various cultivars. In general, all the cultivars were found to contain high fraction of reducing sugar as a part of total sugar. The acidity in terms of citric acid was quite high (1.78%) in cv. Basin seedless, and least (0.189%) in cv. Jodhpur Red.

Key words: Pomegranate cultivars, arid conditions, physical parameters, chemical parameters.

Pomegranate (*Punica granatum* L.) of the family Punicaceae is one of the important and favourite table fruits of the tropical and sub-tropical regions of the world, which is valued highly for its refreshing juice with nutritional and medicinal properties. It is cultivated all over the country owing to its hardy nature, versatile adaptability, low maintenance cost, high yield and good keeping quality, with high export potential (Khodade *et al.*, 1990). Recently the farmers of Rajasthan have taken up the cultivation of this fruit crop due to its drought-hardy nature and suitability to the marginal lands. To further boost its cultivation, studies on evaluation and selection of cultivars suitable for arid zone were carried out at the Central Arid Zone Research Institute, Jodhpur (Bankar and Prasad, 1992). Information on physico-chemical characteristics of different cultivars grown under arid conditions is,

however is meager and, therefore, the present investigations were undertaken.

Materials and Methods

Nine important cultivars of pomegranate namely P-23, Dholka, GKVK-1, Jodhpur Red, G-137, Basin seedless, P-26, Jalore seedless and Ganesh, growing at Central Research Farm of Central Arid Zone Research Institute, Jodhpur, were selected for this study. The experiment was laid out in RBD with three replications. The fruits developed from July to September flowering (*mrig bahar*) were used for experimental purposes. Five fruits from each plant, collected at maturity stage, were brought to the laboratory in polythene bags and analysed for various physico-chemical characteristics. For physical parameters, weight of fruit (g), size (length and diameter) of the fruit (cm), aril and rind (% of fruit weight basis), juice and seed (% of both on

Table 1. Physical parameters of the fruits

Cultivars	Fruit size (cm)		Fruit weight (g)	Juice in fruit (%)	Seed (%)	Aril (%)	Rind (%)	Juice in aril (%)	Seed in aril (%)	Crack- ing (%)	Yield (kg plant ⁻¹)
	Dia- meter	Length									
P-23	7.8	7.3	309.73	50.91	11.72	61.97	38.03	81.09	18.91	35.39	10.65
Dholka	7.8	7.2	259.37	51.23	12.63	63.85	36.32	80.97	18.73	31.27	9.10
GKVK-1	7.1	6.6	271.17	43.51	12.85	60.14	45.95	71.08	20.16	36.01	10.67
Jodhpur Red	7.2	7.1	222.33	40.85	18.45	54.51	39.85	68.28	31.43	59.00	7.85
G-137	7.8	7.3	273.83	46.52	10.86	57.37	42.85	78.49	20.37	26.37	9.92
Basin seedless	6.9	6.9	256.30	40.66	9.15	50.01	49.32	79.51	20.09	25.50	9.37
P-26	7.7	6.8	285.47	51.09	11.96	62.00	37.57	79.73	20.24	31.90	8.82
Jalore seedless	7.6	7.6	322.17	52.68	10.33	61.53	36.40	83.67	16.33	22.10	12.73
Ganesh	7.3	6.8	297.80	48.33	10.74	59.57	38.92	81.45	17.88	29.40	10.26
F. Test	NS	NS	**	**	**	*	**	**	**	**	NS
C.D. (0.05)	-	-	18.17	2.37	1.41	1.19	6.71	2.24	1.45	4.73	-

* Significant at 5%, ** Significant at 1%.

fruit, as well as aril weight basis), cracking (%) and yield per plant (kg) were recorded. Similarly, total soluble solids (TSS) of the juice was recorded by hand refractometer and expressed as °Brix. Titrable acidity of the juice was determined by titration method (A.O.A.C., 1990). The total sugar was estimated as per the method described by Yemm and Willis (1954) and reducing sugar was estimated as per method given by Nelson (1944). pH of the juice was measured by pH meter.

Results and Discussion

Physical parameters

Weight and size of fruits: The inter-variety differences in respect of fruit weight were significant (Table 1). The fruit weight ranged from the lowest of 222.33 g in cv. Jodhpur Red (local) to as high as 322.17 g in cv. Jalore seedless (recommended for commercial cultivation in arid and semi-arid regions of India), followed by Ganesh and P-23. The

cultivars such as Dholka, G-137, Basin seedless, P-26 and GKVK-1 produced fruits of medium weight. The fruit diameter ranged from 6.9 cm, as recorded in Basin seedless, to 7.8 cm in G-137, Dholka and P-23, but the inter-variety differences were non-significant. The minor deviations in size (length and diameter), with respect to fruit weight, may be due to the variation in the fruit form as sometimes they are obscurely ridged, as observed by Nath and Randhawa (1959).

Juice and seed per cent on fruit weight basis: The juice percentage was significantly higher in cvs. Jalore seedless, G-137, Ganesh and P-23, as compared to Jodhpur Red and Basin seedless (Table 1). Being of different genetic trait, the cultivars differ in their juice content. Similar results were also obtained by Cheema *et al.* (1949). Siddappa (1943) reported that the juice content of pomegranate aril, in general, is quite high.

Table 2. Chemical parameters of the fruits

Cultivars	Total sugar (%)	Reducing sugar (%)	Non-reducing sugar (%)	pH	Acidity (%)	T.S.S. (°Brix)
P-23	14.78	14.42	0.36	2.01	0.3239	17.67
Dholka	14.88	14.37	0.51	2.96	0.4128	18.00
GKVK-1	14.99	14.73	0.26	3.02	0.3298	18.00
Jodhpur Red	13.86	13.39	0.47	3.44	0.1895	15.33
G-137	14.88	13.97	0.87	3.54	0.3823	17.16
Basin seedless	15.88	15.69	0.19	3.12	1.7843	19.33
P-26	14.49	13.56	0.93	2.82	0.3969	17.33
Jalore seedless	14.56	13.35	1.21	2.98	0.3950	18.33
Ganesh	14.36	13.35	1.01	3.00	0.3950	17.00
F. test	**	**	**	NS	**	*
C.D. (0.05)	0.39	0.44	0.01		0.0165	1.3

* Significant at 5%, ** Significant at 1%.

The seed per cent varied from 9.2 in Basin seedless to 18.5 in Jodhpur Red, which was significantly higher than in other cultivars. The reasons may be that most of the cultivars under study were soft seeded, except Jodhpur Red, which was hard seeded. Jalore seedless, G-137, etc., had seeds of light weight, thus indicating their soft seediness quality. This further confirms the findings reported by Bankar and Prasad (1992).

Per cent aril and rind on fruit weight basis: The aril per cent was significantly higher in cvs. Dholka, P-26 and P-23 and others over Jodhpur Red and Basin seedless. However, the rind per cent did not vary significantly in all the cultivars. It was maximum (49.32%) in Basin seedless and minimum in cv. Dholka (36.32%). These differences may be attributed to the varietal characteristics.

Juice and seed per cent on aril weight basis: The juice per cent was significantly higher in cv. Jalore seedless and Ganesh

as compared to other cultivars (Table 1). On the other hand, cv. Jalore seedless had less seed, as low as 16.33%, followed by Ganesh (17.88%), whereas the maximum (31.43%) seed content was recorded in Jodhpur Red. Similar results were also obtained by Malhotra *et al.* (1983a).

Per cent cracking and yield: It is apparent from Table 1 that maximum cracking (59.0%) was in cv. Jodhpur Red and minimum in cv. Jalore seedless (22.1%). The range of cracking, in other cultivars, was between 25.50% and 36.01%. The higher cracking percentage may be attributed to the weather, particularly the prevalence of higher temperature and moisture stress (Phadins, 1974; Shulman *et al.*, 1984). However, the yield per plant of different cultivars did not vary significantly. The cv. Jalore seedless produced maximum (12.7 kg plant⁻¹) yield. In other cultivars, it ranged from 9.1 to 10.7 kg plant⁻¹ (Table 1).

Chemical parameters

Total soluble solids (TSS): The TSS in the juice of the different cultivars ranged from 15.3% in Jodhpur Red to 19.3% in Basin seedless. However, the inter-varietal differences were statistically comparable and at par (Table 2). These values correspond to those reported by Siddappa (1943) and Shulman *et al.* (1984).

Sugars: The highest total sugar content (15.88%) was recorded in Basin seedless, and this value is significantly higher than those recorded in all other cultivars. The inter-varietal differences for total, reducing and non-reducing sugars were recorded as significant. In reducing sugar, all the cultivars were quite rich as this fraction constituted about 90 to 98% of the total sugar (Table 2). The non-reducing sugars, as estimated in different cultivars, were quite low, constituting about 2-8% of total sugar. Similar results were also recorded by Malhotra *et al.* (1983a) and Khodade *et al.* (1990). The accumulation of sugars, particularly the reducing sugars, may be attributed to the genetic characteristics of the fruit. Siddappa and Bhatia (1954) also reported as high as 98% of total sugar as reducing sugar in pomegranate.

Acidity and pH: Total organic acid (as citric acid) ranged from the lowest of 0.1895% in Jodhpur Red to as high as 1.7843% in Basin seedless. The inter-varietal differences were highly significant (Table 2). The prevalence of wide variation in acid content in the juice of different cultivars, as recorded in the study, is probably the reason to use this character to classify the pomegranate cultivars as sweet, sour or bitter sweet (Cains, 1940;

Cheema *et al.*, 1949). pH of the juice did not vary significantly in the cultivars under study.

Thus, on the basis of physico-chemical characteristics of different cultivars, it is concluded that the cv. Jalore seedless, which is recommended for commercial cultivation in arid region, is also having more average weight of fruit with bigger size, maximum juice content, both on fruit weight and aril weight basis, with least cracking and maximum yield. Similarly, the total sugars were also on higher side in this cultivar as compared to that in other cultivars.

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